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REMARKS

The application now contains claims 1-10, 12-27 and 29-35. None of the claims are amended.

Claims 1-9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Berlad et al. ('195). Applicants respectfully traverse this rejection and submit that the Examiner has not presented a *prima facie* case of obviousness.

In the prior art, as exemplified by Berlad and others of the references applied in this case, the following procedure is followed:

- 1) Events impinge on a detector and cause a scintillation whose position is determined;
- 2) the events are classified or filtered according to energy and position and other corrections are performed; position of the events is determined; and
- 3) the events increase a counter in a register of counts (binning). For single pixel Gamma cameras, each register corresponds to a pixel on the surface of the gamma camera. For PET cameras, the register corresponds to a pixel pair of events which correspond to an approximate line of sight of the emissions.

In each case the identity of the individual pixels is lost once the counter is incremented and further processing takes place to generate an image based on the number of counts in each register.

While there do exist cameras which log individual events, the reconstruction process takes place on the groups binned events and not on individual events.

Claim 1 on the other hand defines the invention as including: "*separately* distributing a weight of *each* of the *individual* nuclear events along a line of flight..." In the prior art process, and in Berlad which follows that process, there is no separate distribution of weights of each individual event along a line of flight. Rather, all of the events in a pixel are distributed together. In fact, in a very real sense, all of the events in the entire view are distributed together.

The Examiner has cited the following portions of Berlad as supporting the contention that the claim is obvious. None of the portions cited contain the limitation referred to in the previous paragraph.

Fig. 1 and col. 5, lines 25-28 shed no light on how the reconstruction is carried out.

Col. 5, lines 39-42 of Berlad are directed to step 2 of the standard prior art process. They are concerned with the initial determination of the position and not with the distribution of weights. Applicants note that col. 5, line 55 to col. 6, line 2 specifically states that the events are

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placed in position matrices as counts, namely step 3 of the normal process. After placing them in such matrices the identity and exact positions of the individual events are lost.

Col. 5, lines 55-68 and col. 6, lines 1-8 clearly teach making the x-y correction on individual elements in order to determine which position register should be incremented. Of course, the position correction is made on the individual events. However, once these are placed in matrices that "correspond to pixels in the final image" the individual identity of the events is lost.

The reference made to Rogers on page 3 (in bold) says no more than what was already said in the Berlad application. The Examiner's contention that the position of each event on the detector is known is not exact. While the positions of the events are known to the nearest pixel, nearby events are all stored (as counts) at the same location. Thereafter, the counts are distributed as a group. Clearly, with the exact information as to position lost in the binning process, there is no reason to distribute the events having the same pixel address separately, which would have no positive effect and would require orders of magnitude more calculation.

Finally, the Examiner's statement as to energy weight distribution is not believed to be relevant, since events having each energy in Berlad are binned, albeit in separate matrices. (See col. 5, lines 58-66.)

Claims 2-9 and claims 12-21 and 24-30 (as ultimately dependent on claim 1) are patentable for at least the same reasons as claim 1. Applicants have not argued these claims separately, due to the lack of a *prima facie* case for obviousness of parent claim 1.

Applicants thank the Examiner for the allowance of claim 10 and claims dependent on claim 10.

Claims 22, 23-27 and 29-30 (as dependent on claim 22) and 31-35 and claims 1, 6, 8-9, 12/6/1-18/6/1 and 24/1-26/1, 29/1 and 30/1 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Rogers in view of Hasagawa 4,675,526. Applicants respectfully traverse all of these rejections and submit that the Examiner has not presented a *prima facie* case of obviousness. This group of claims contains independent claims 1, 22 and 31. These are argued below with respect to each of the rejections.

Claim 1 contains the limitation of "*separately* distributing a weight of *each* of the individual nuclear events..." Claim 22 contains the limitation of "*iteratively* reconstructing a three-dimensional image from the *unbinned* individual nuclear events." Claim 31 contains the limitation of "*reconstructing* the image utilizing an expectation maximization (EM) method acting

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on *individual unbinned* events." Applicants submit that none of these limitations is taught by either Rogers or Hasagawa.

Applicants turn first to Rogers. As with Berlad, Rogers describes a gamma camera which has the first two steps defined above with respect to the discussion of Berlad. This is in fact evident from the very citations of the Examiner. There is no mention of any reconstruction algorithm.

The Examiner cited col. 1, lines 5-10. This general statement does not teach any of the limitations referenced above with respect to claims 1, 22 and 31.

The Examiner cited col. 3 lines 15-18. This statement does not impact on the patentability of the independent claims, since the referenced limitations are not taught. The cited statement does no more than indicate that the camera can be used for either PET or single photon image generation.

The Examiner has cited col. 4, lines 52-54. This statement says no more than that the camera can be used for tomographic imaging. Again, there is no teaching of the present invention as claimed in the independent claims.

The Examiner has cited col. 3, lines 28-30. The analysis of events before storage does not indicate anything about how the events are stored or subsequently used *in reconstructing the image*. The analysis, taught by Rogers in the cited passages, is just the analysis indicated above in step 2 of the standard prior art method, abut in a somewhat different form. ...

Rogers col. 3, lines 55-68 through col. 4, lines 5 also teaches nothing about the present invention. This paragraph (as the thrust of Rogers) is directed to a more exact method of determining the position of the event so that it can be properly binned. It is well known that the point spread function of a detected event is usually larger than the size of a pixel. Thus, even within the context of the standard process, as described above, there is a need to reduce the point spread function of the camera so that more of the events are placed in the proper bin (pixel) in the matrix. This section teaches nothing with respect to how the events are used after the position is determined.

As to the citation of col. 6, lines 12-18, the Examiner has apparently confused (in this and other citations) analysis of an *event* to properly characterize the event prior to storage and how the events are then *stored and used* in image reconstruction. All of the citations in Rogers deal with analysis of the events *prior* to storage (i.e., when they are still "individual" events), while the

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referred to passages in the independent claims refer to how the events are *used in reconstruction* of the image.

Applicants note that Rogers does not mention how the events are used to form a reconstructed image at all. In fact, Rogers experiments are limited to determinations of the accuracy of characterization of the events that are acquired. Rogers does acquire each of the events and store them, together with extensive information in a list mode form. However, Rogers describes using the list mode only to analyze the events, not to perform reconstruction.

There would be no reason to perform reconstruction as defined in the claims. A person of the art would use the events (with the improved resolution) in the conventional manner absent the teaching of the present application.

The Examiner has also cited Hasagawa.

The references in Hasagawa at col. 1, lines 35-50, col. 5, lines 32-48 and col. 1, lines 62-68 are not relevant to the limitations of the present independent claims that are referenced above. What Hasagawa does teach, as admitted by the Examiner is "cross-sectional or tomographic images are reconstructed of the object *using standard algorithms*." The standard algorithms are just those described in Berlad, which utilize groups of binned events (and not individual or unbinned events) to reconstruct the image of the object or other standard algorithms that operated on binned data.

Applicants note several references by the Examiner to EM and iterative methods for reconstruction. Applicants submit that such methods are conventionally used for binned data. Determination of the line of flight of the events also does not involve any teaching of the limitations of the claims referred to above. Applicants submit that while it might be obvious to provide an improved detector (as in Rogers) in the device of Hasagawa, this would still not make the claims *prima facie* obvious since at least one limitation of the claims is missing from the combination.


Applicants also note that some of the claims being rejected are not enumerated in the first paragraph of section 5 (page 6) of the action. However, in view of the fact that applicants are arguing only the independent claims at this time, this problem is moot. However, since the rejection of claim 27/1 (although listed on the cover page of the action as being rejected) is not mentioned at all in the body of the action, there is clearly no *prima facie* rejection of this claim presented in the action. In the event that the Examiner does not accept applicants' arguments for patentability, applicants submit that a final rejection would be premature.

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In view of the above arguments, applicants submit that the claims are patentable and that the application is in order for allowance. Notice to that effect is respectfully solicited.

If the Examiner is unable to allow the application based on the above arguments, and intends to issue a final rejection, applicants respectfully request a telephone interview, prior to the issuance of a final rejection. The undersigned can be reached at 1-877-428-5468, which is a toll free number, direct to undersigned's office in Israel. The undersigned can normally be reached at this number until about 11:00 AM EST, Monday through Thursday.

Respectfully submitted,
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